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The Los Angeles Fires of March 16, 1964

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ABSTRACT: March 16 and 17, 1964, three fires in the mountains at the edge of Los Angeles burned 11,650 acres, destroyed 20 houses, severely damaged 10 others, and threatened hundreds more. Santa Ana winds were a major contribution to the extensiveness of the damage. An unusual number of spot fires was probably the result of the fuel moisture condition--low enough for fuels to ignite, high enough for them to burn for some time.

Among fire-control workers, southern California is known only half jokingly as "the land of the 13-month fire season." The Mediterranean-like climate that each year attracts thousands of new residents to southern California, and a distinctive complex of topography and wildland fuel result in conditions under which major fires can and do occur every month of the year.

The great population influx into southern California has also served to create a fire-fighting problem probably without parallel anywhere else in the world. Residential sub-divisions have been pushing farther and farther into the steep, chaparral-covered mountains surrounding the Los Angeles Basin and most other major cities in southern California (fig. 1). Houses are often perched on ledges which have been bulldozed into the steep mountain slopes or located in steep narrow canyons or sharp ridges. Access roads are usually narrow and winding (fig. 2). Roads and houses alike are surrounded by chaparral vegetation that sometimes is virtually impossible to ignite while at other times can be turned into a holocaust by a spark (fig. 3). California "ranch style" architecture often specifies esthetically pleasing but highly flammable building materials.

Compounding the already enormous fire hazard is the constant threat of the foehn-type Santa Ana winds. Originating as cold, dry air high in the troposphere, these winds sweep down from over the Great Basin area, warming and drying as they come. Reaching the ground near the desert rim, they roar down the mountain slopes and canyons to the sea. Wind speeds may often reach 100 miles per hour or more in exposed areas, and humidity frequently approaches the vanishing point. Under these conditions fuels that may have been soaked by rain a few days before quickly become tinder dry.

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Figure 1. --Residential areas in chaparral-covered mountains complicate fire-fighting problems.

Figure 2. --Narrow access roads hamper suppression activities.

Figure 3. --Roads and houses are surrounded by chaparral.

Fires starting under such wind conditions are driven downhill as rapidly as up. The rough, broken topography and high wind speeds create highly turbulent air flow in the many canyons. Wind direction in these areas may switch 180 degrees and back again in a few seconds. Dense smoke clings to the ground and a hail of burning embers may be driven into houses, under shingles or roof tiles, and into roof ventilators.

March 16, 1964, Santa Ana winds, the strongest of the year, suddenly struck the Verdugo Mountain area above the cities of Glendale and Burbank. Three fires, the Chevy Chase, the Whiting Woods, and the Weldon, started within a short time of each other. Two of these fires were believed to have been ignited by high tension lines arcing in the high wind. The third was started by a burning house. Despite desperate efforts by fire-control forces the fires spread rapidly. Before they were brought under control March 17 they burned 11,650 acres in the cities of Burbank, Glendale, Pasadena, and Los Angeles. The fires destroyed 20 houses, severely damaged 10 others, and threatened hundreds more.

BURNING CONDITIONS

PRECIPITATION

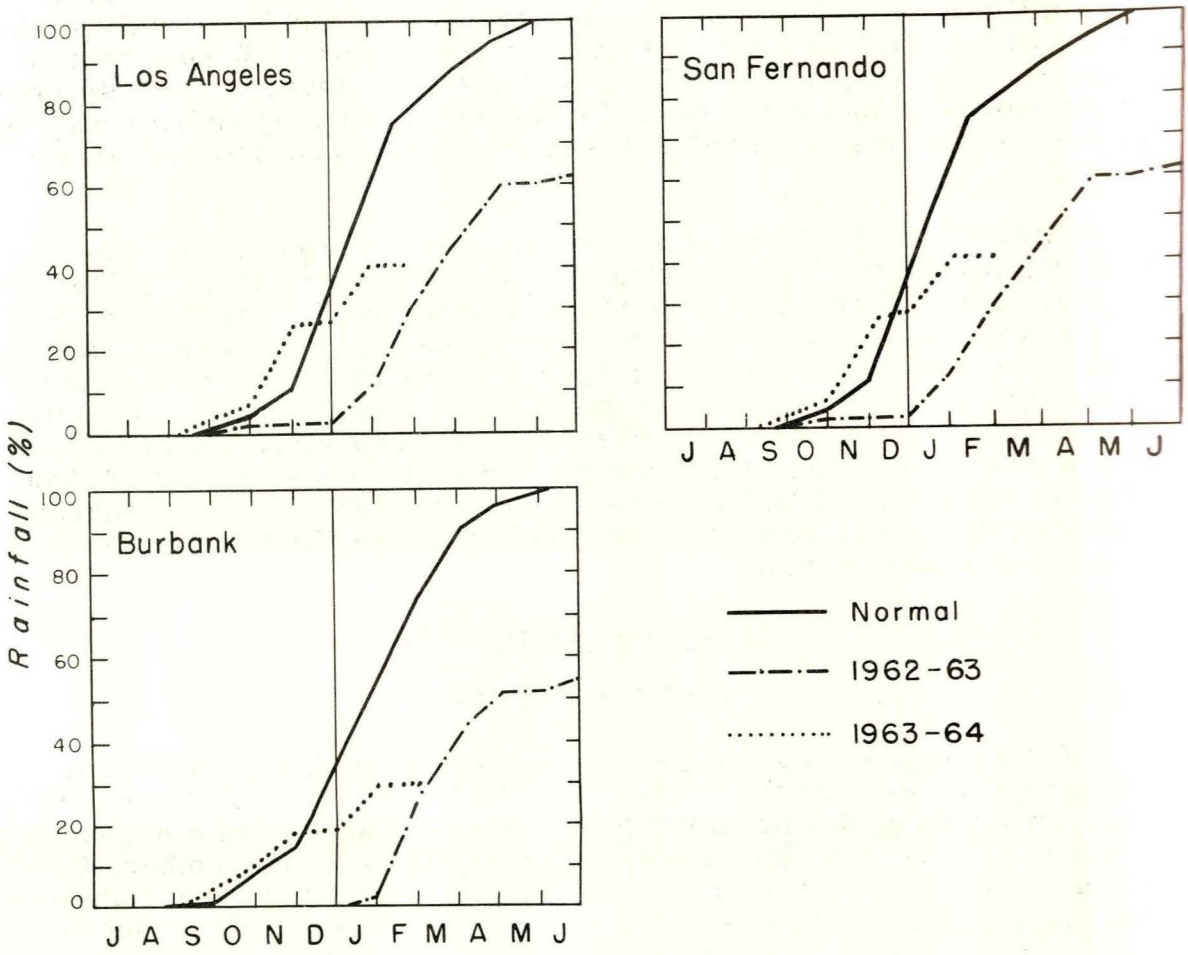
Although the 1963 summer fire season in southern California was one of the easiest on record, the situation changed by March 1964. Fall rains started unusually early in 1963--as early as late August in some areas. Substantial amounts of precipitation in September, October, and November (figs. 4, 5, and 6) started grass and other annuals growing and greatly reduced the fire hazard. No rain fell in December, but January 1964 had near normal rainfall. February was rainless and only a small amount of rain was measured during early March.

SANTA ANA WINDS

In most years the Santa Ana "season" starts late in September. Santa Ana periods then increase in frequency in October and November and begin to taper off in December. A Santa Ana after the middle of January is usually an infrequent occurrence. During 1963, however, there were very few Santa Ana winds, and those that did occur were relatively mild. After the first of January 1964, Santa Ana winds began to occur with increasing frequency. Some of these were quite severe. The Riverside airport reported twice as many closures because of wind during January and February as in a normal year. Wind damage was severe in many areas.

The strong, dry winds began to wipe out the effects of the early precipitation. Grass and annual vegetation growth stopped and plants began to wither. Fire hazard began to rise rapidly.

The March 16 Santa Ana.--The development of the March 16 Santa Ana during which the Chevy Chase, the Whiting Woods, and the Weldon



Figures 4, 5, 6. --Cumulative precipitation: (4) Los Angeles City, (5) San Fernando, (6) Burbank.

fires burned was typical of many Santa Anas (figs. 7 - 14). At the 500 m b. level a minor trough moved across Oregon. As the trough moved into Nevada and Utah it began to deepen and then it moved southwest into southern California. Once in California it turned into a closed low pressure area and moved into Baja California and northern Mexico. An east-west ridge formed across northern California to Denver.

At the surface a cold front began moving across Oregon on Sunday (March 15) and passed through southern California Sunday night. A high pressure ridge then moved into Oregon and developed into a closed high pressure area late Sunday night. The relative position of the high and low pressure areas set up the conditions necessary for a Santa Ana. The jet stream was located over the area and probably contributed to the high winds (fig. 15).

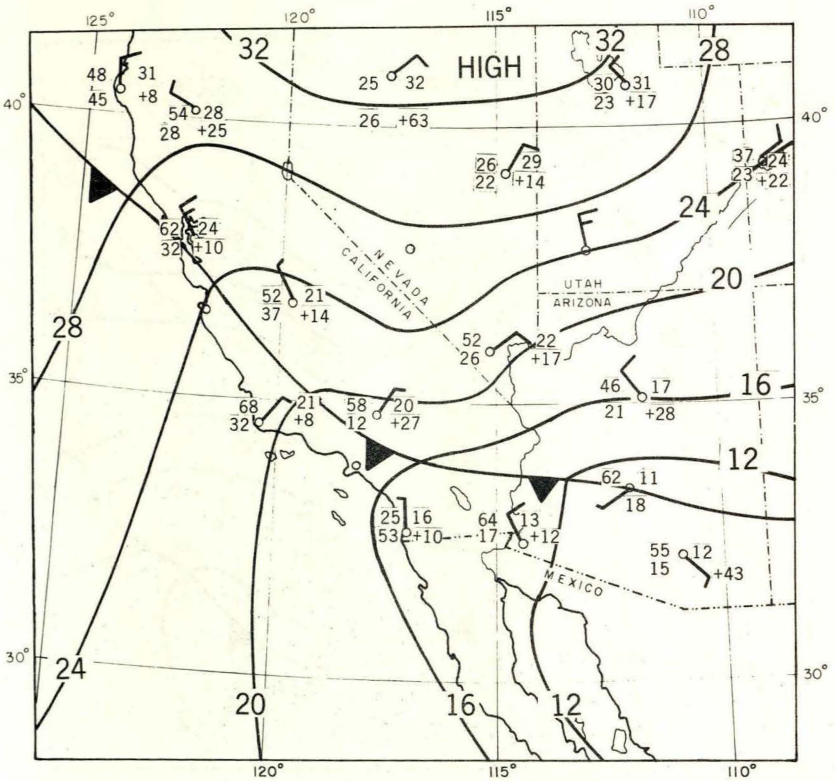


Figure 7. --Surface weather map 2200 Hours March 15, 1964.

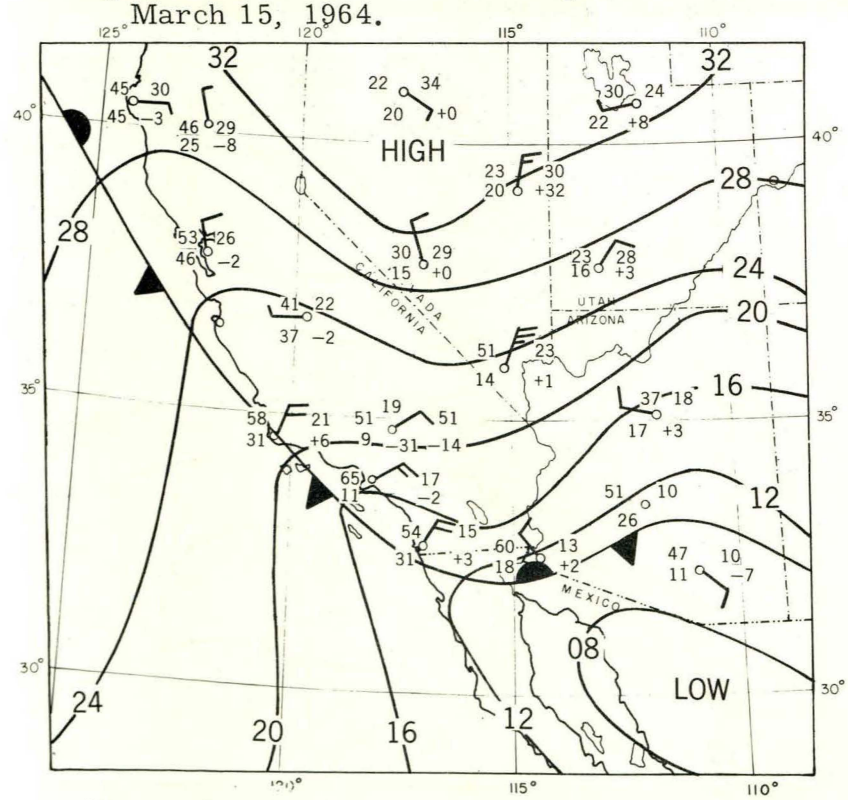


Figure 8. --Surface weather map 0400 Hours March 16, 1964.

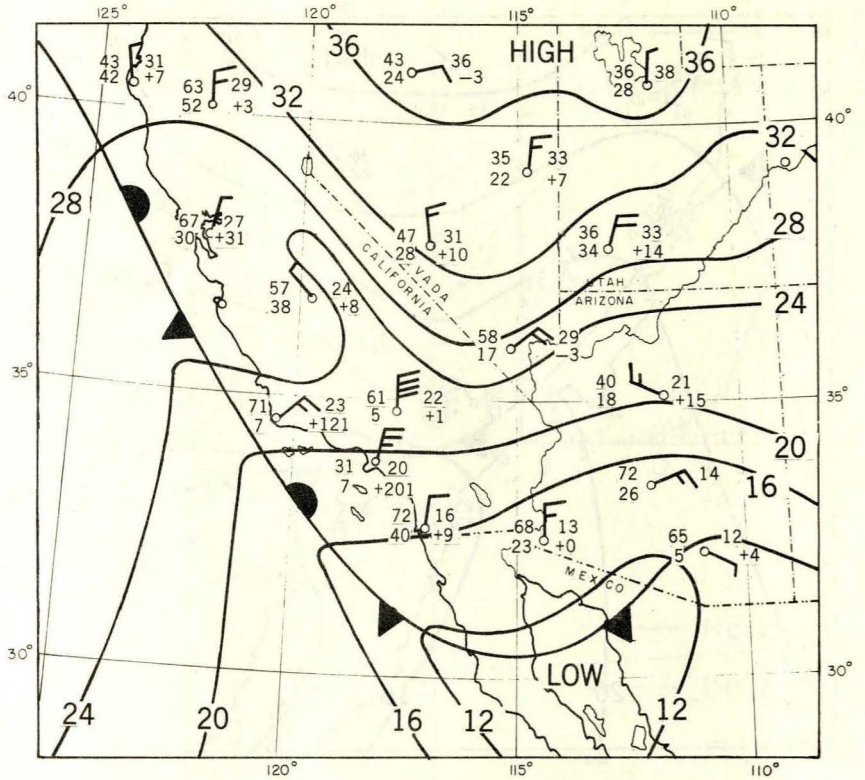


Figure 9. --Surface weather map 1000 Hours March 16, 1964.

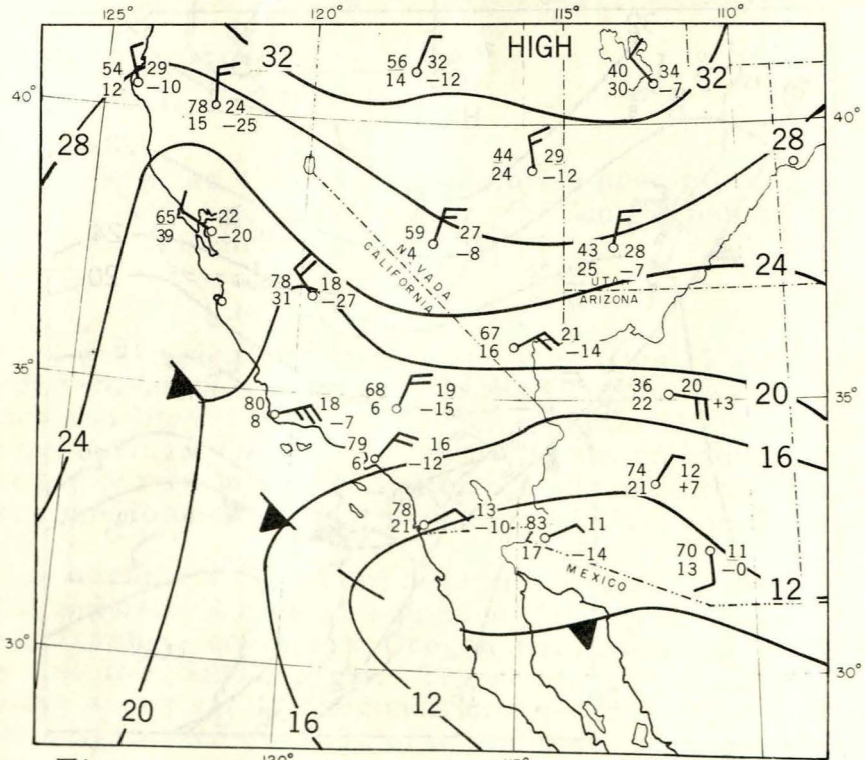


Figure 10. --Surface weather map 1600 Hours March 16, 1964.

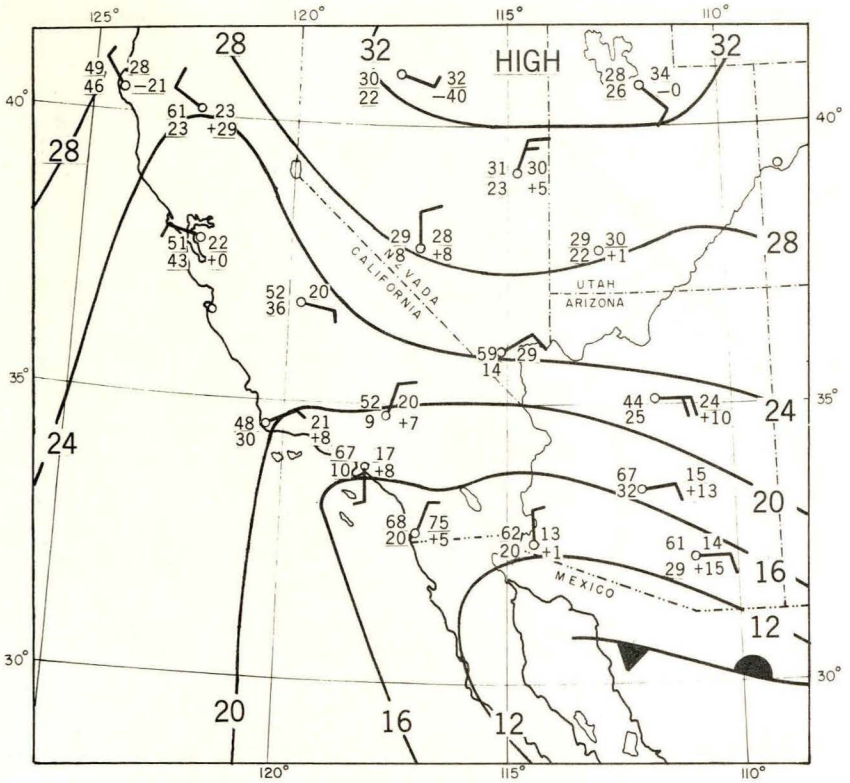


Figure 11. --Surface weather map 2200 Hours March 16, 1964.

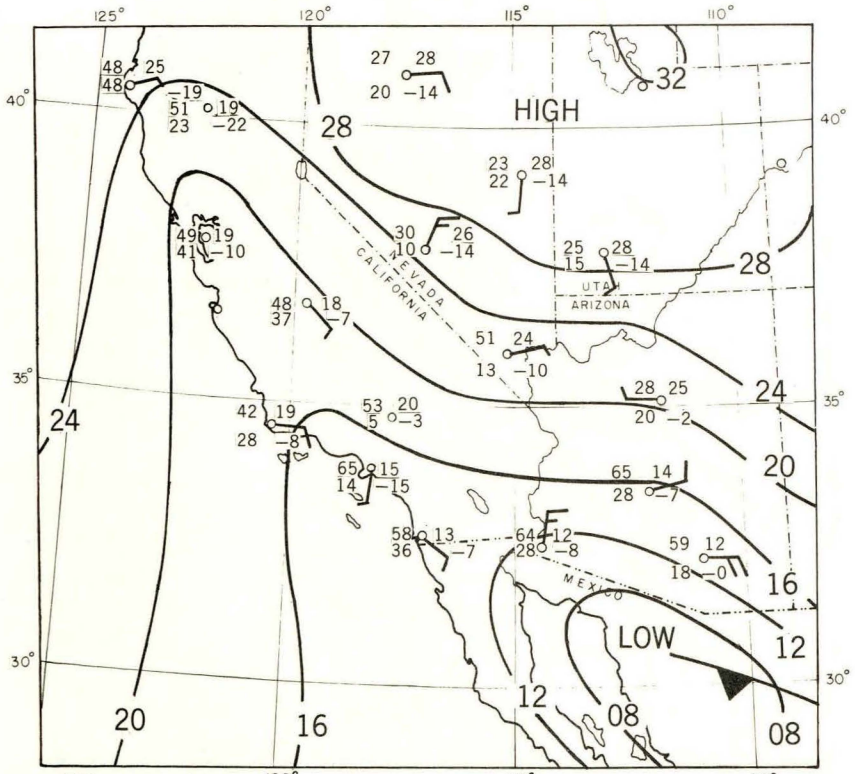


Figure 12. --Surface weather map 0400 Hours March 17, 1964.

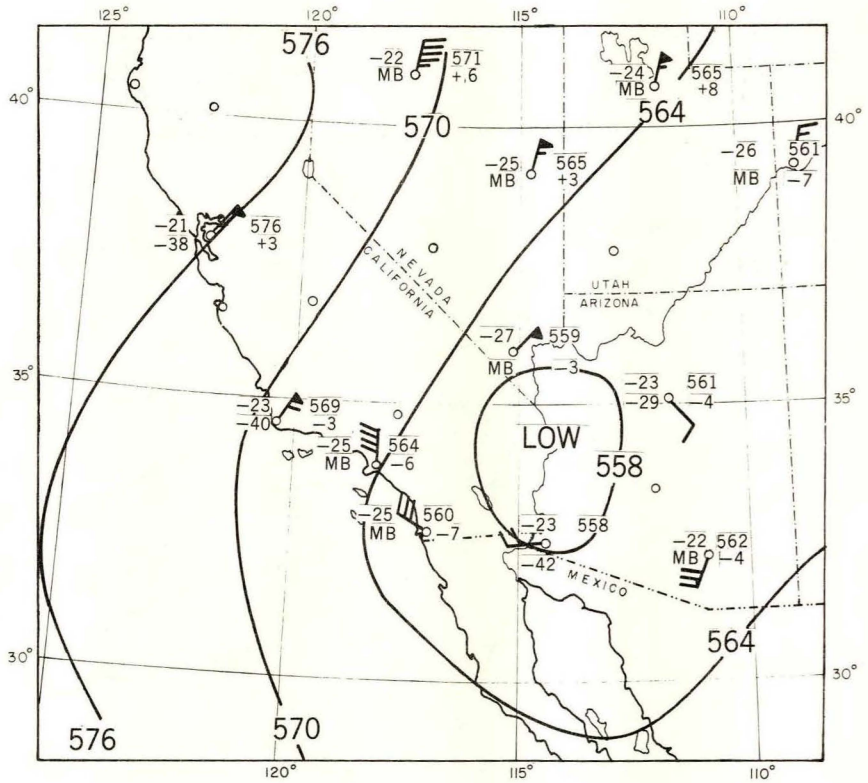


Figure 13. --500 MB. weather map 0400 Hours March 16, 1964.

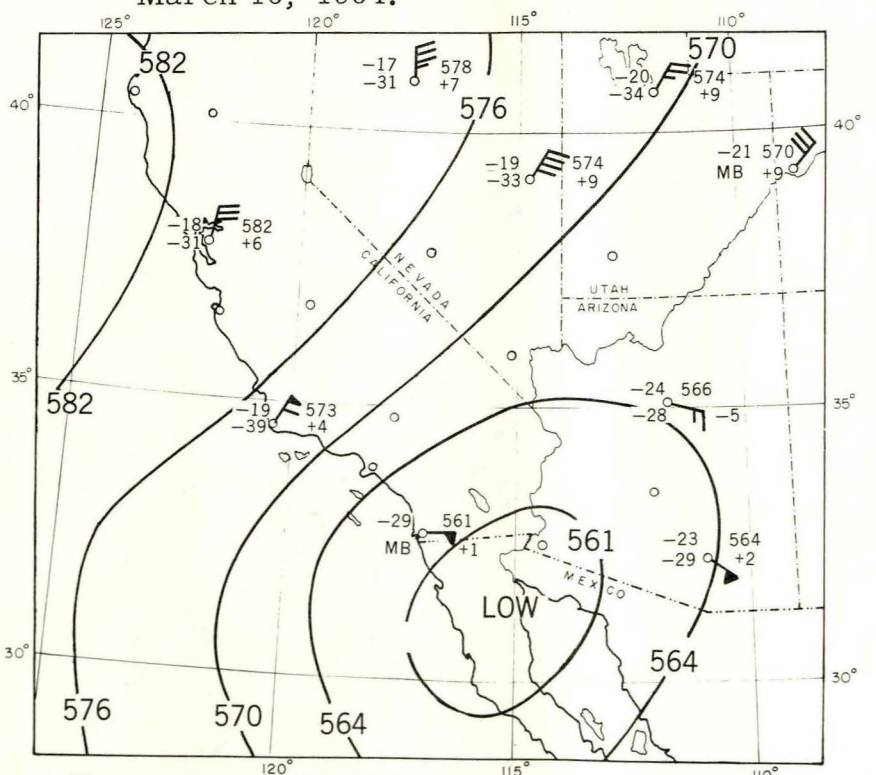


Figure 14. --500 MB. weather map 1600 Hours March 16, 1964.

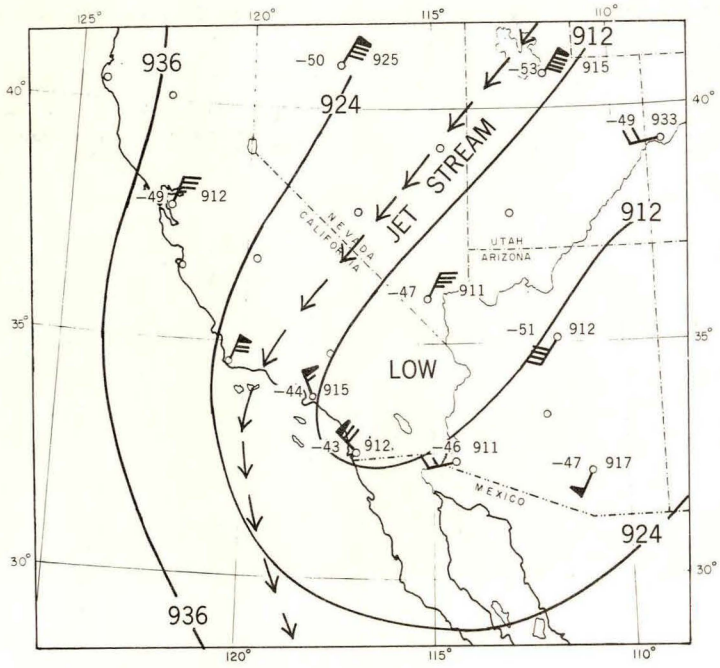


Figure 15. --Jet stream location 0400 Hours March 16, 1964.

The Santa Ana wind began Monday morning and quickly reached high speeds. At Sierra Pelona Lookout a wind speed of 61 m.p.h. was reported the morning of March 16. Extensive wind damage in Burbank and Glendale was estimated to approach $2,000,000.

FIRE DANGER INDEX

The multiple basic index system of fire danger rating is used in California. In this system separate indexes of rate of fire spread, the burning intensity, and the ease of ignition are integrated into a single index (Fire Load Index). This provides a relative measure of the potential size of the job load that may face the fire control organization. All indexes have linear scales with values from 0 to 100.

Information was available from two fire weather stations near the fire areas. The Newhall station had a Fire Load Index of 100, the highest possible on the scale, March 16 (table 1). The Chatsworth station, which was out of the direct path of the high winds, gave a reading lower but still in the extreme fire danger range (extreme fire danger is considered to occur with a Fire Load Index of 36 or higher).

FIRE BEHAVIOR

In general fire behavior was similar to that usually experienced under strong Santa Ana winds in rugged terrain. Under the influence

Table 1. Weather conditions and fire danger indexes, Chatsworth and Newhall fire weather stations, March 13-18, 1964

Date	Temp.	RH	Wind speed	Fine fuel moisture	Spread	Intensity index	Ignition index	Fire load index
	°F.	Pct.	M.p.h.					
CHATSWORTH								
13	62	37	5	7	8	17	37	2
14	73	20	8	4	20	28	67	8
15	74	24	12	5	25	28	59	6
16	78	11	22	3	73	44	79	46
17	78	11	11	3	29	44	79	21
18	74	24	12	5	25	40	59	11
NEWHALL								
13	60	40	15	7	24	20	37	5
14	73	17	12	4	29	44	67	18
15	74	12	18	2.5	56	51	81	49
16	73	5	41	1.5	100	66	92	100
17	79	7	14	1.5	47	70	94	63
18	79	17	13	3	34	70	79	34

Table 2. Weather and fuel-moisture conditions at specified southern California locations, March 16 and 17, 1964

Time	Place	Weather			Fuel moisture percent (average)		
		Dry bulb	Wet bulb	Relative humidity	Type	Old-growth live fuels	Dead fuels
		°F.	°F.	Pct.		Pct.	Pct.
March 16, 1964							
1500	Whiting	77	51	10	Chamise	92.9	8.4
1630	Whiting	72	48	10	Chamise	97.9	5.3
1715	Chevy Chase	78	52	11	Chamise	96.2	9.7
1800	Chevy Chase	77	49	5	Chamise	91.6	6.3
2030	Whiting	73	48	8	Chamise	97.8	5.8
2230	Whiting	70	45	7	Chamise	99.5	6.7
March 17, 1964							
0300	Weldon	66	44	8	--	--	--
0200	Whiting	67	44	6	Chamise	123.9	5.2
1430	Weldon	77	52	15	Sagebrush	175.7	5.2

Figure 16. --Whiting Woods fire about 1600 Hours March 16, 1964.

of the wind, the fires spread rapidly. Very turbulent winds in the canyons spread fire in all directions. Smoke was held close to the ground (fig. 16).

There was an unusual amount of spotting in all three fires. This was probably because of the fuel moisture conditions. The moisture of the living chaparral in southern California usually follows a definite seasonal pattern (fig. 17). In the spring the plants put out new growth, and the moisture content increases quickly to a high level--so high that chaparral burns quite slowly if at all. The new growth then matures and eventually becomes dormant during the late summer and fall. As the plant foliage matures, the moisture content decreases more or less gradually, reaching a minimum in September. The moisture content remains near this minimum level until growth starts again in the spring. Because of the oily nature of many of the chaparral species, the foliage will burn well at the dormant moisture content stage. Moisture of dead fuels in the chaparral follows closely the current humidity and temperature conditions.

Samples of fuels taken during the March 1964 fires showed the living fuel moisture to be at about that expected in September in a normal year (table 2). Dead fuel moisture was low enough to ignite readily and burn intensely. The dead fuels thus provided the place for spots to ignite and to spread fire. The living fuel material contained enough moisture so that it remained afire long enough for the wind to carry burning material considerable distances. Numerous spots were observed to start and quickly develop into running fires more than a one-fourth mile from the source of the firebrands.

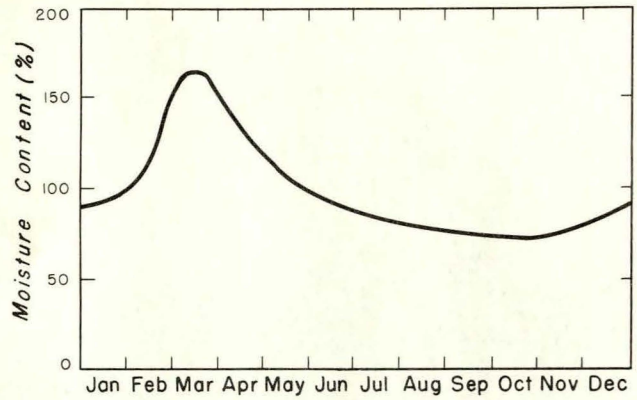


Figure 17.--Typical pattern of moisture content of chamise foliage in southern California.

Diminishing wind and the combined efforts of the fire departments of the cities of Glendale, Burbank, Pasadena, and Los Angeles and fire fighting forces from Los Angeles County, the California Division of Forestry, and the U. S. Forest Service slowed the spread of the fire during the night of March 16. The fires were declared under control by 5:00 p.m., March 17.

The aftermath.--Soils in the mountains of southern California are very unstable. Soil movement often begins immediately after an area is denuded of vegetative cover by fire. When rain falls on the bare slopes, erosion rates and soil movement increase greatly. A few days after these March fires were out, a moderate rain storm moved over the area. Mud flows and water-carried debris from the burned areas caused extensive damage to many of the houses that survived the fire unharmed. More damage from floods and erosion will remain a potential threat until vegetation again covers the slopes.

FIRE CONTROL NEEDS

These fires were typical of a recurring pattern in southern California. To break this pattern, the fire-control agencies have long urged: a better warning system, more firefighting forces, and better local ordinances.

The U. S. Weather Bureau does an excellent job of predicting Santa Ana winds but conditions change very rapidly. A critical fire situation can arise between regular reports. Consequently a continuous warning system is now a possibility. It would include a complete network of weather stations telemetering hourly reports to a central location. In addition, there is need for a more thorough understanding of the Santa Ana winds, fire behavior, and fuel moisture to permit predictions at an earlier stage.

The fire control organizations that must cope with fires in southern California's fuel complex of wildland, vegetation and structures are perhaps the finest fire fighting organizations of their kind in the world. They have the latest in equipment and have experienced, highly trained manpower. Less than 1 percent of the fires escape initial control action and become disasters. On fires that do become large, very few of the structures threatened are destroyed, chiefly because of the skilful deployment and efficient use of equipment and manpower available. Such a record is almost unbelievable considering the fuels, weather, and topography, the risk of fire starting, and the length of fire season.

In spite of this, on very large and fast spreading fires, or with more than one large fire as in the March 16 situation, there often just isn't enough manpower and equipment to cover all fronts. Forces must be deployed to protect life and property, thus slowing efforts to control fire spread. More fire fighting force then would undoubtedly help in reducing burned areas. Increased fire fighting forces would also permit stronger initial attack and lessen the chance of a fire becoming large. New equipment for fire line construction needs to be developed.

And, finally, fire chiefs and many others have emphasized the critical need for better local ordinances, ones calling for more fire-resistant construction, clearings around buildings, better access roads, and more adequate water mains. This could lessen the fire threat to structures and enable fire fighters to devote more forces to stopping fire spread.

Fire control can be improved greatly through these and other measures. But the problem itself can only be reduced through research. In the long run the greatest hope for major improvement lies there.

CLIVE M. COUNTRYMAN has had more than 20 years' experience in forest fire research--particularly in the problems of fire behavior and environment. He joined the Forest Service in 1939, and is now headquartered at the Riverside, California, forest fire laboratory. He received his bachelor of science degree in forestry from the University of Washington.